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MEDICAL DISCOVERIES BY THE NON-MEDICAL

GEORGE M. GOULD, M.D.
PHILADELPHIA

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I have been struck by the fact that the majority of great medical discoverics, truths and instruments, havc not been madc completely and suddcnly, but have bcen led up to by preliminary and progressive steps, and that the layman has so often made these discoverics prior to the medical practitioner. This great medical truth is, indeed, but an illustration of the general law that all professional progress, in whatever branch of study, is somehow or othcr a result of stimulus from without. There is so much interest, and there are so many lessons to be drawn from such observations in mcdical history, that I have in late years kept minutes of this class of truths, from which I make the following selections:

When we commence obscrvation of the origins of medical discovery and treatment, we are struck by the fact that "our brothers the animals" were first in learning not a little of medical art. It has been noticed[1] that birds often show a truc surgical instinct. M. Tatio on several occasions has killed woodcock that werc, when shot, convalescing from wounds previously received; and in every instance found the old injury neatly dressed with down, plucked from the stems of feathers, and skilfully arranged over thc wound, evidently by the beak of the bird. In some instances a solid plaster was thus formed, and in others ligatures had been applied to wounded or broken limbs. Ten times in his experience he has found birds whose limbs had been broken by shot with the fractured ends neatly approximated and ligated together—a statement that is vouched for by no less a naturalist than Fulbert Dumonteil. Dr. James Weir[2] says that when bees are attacked with

diarrhea they at once begin to suck astringent pieces of the dogwood, poplar, wild cherry, or hickory, and readily cure themselves. Their instinct carries them so far that "in winter if they should happen to be afflicted with diarrhea, they will readily drink a decoction of wild cherry if it is placed in the hive. Moreover, they seem to know that filth is a source of disease, for in winter all the sick members of the hive deposit their dejecta as far from the combs as possible. As soon as warm weather arrives, the accumulated filth is removed and the spot carefully cleansed." Dr. Weir further believes that many of the higher animals have discovered and use a materia medica that should be recognized by human physicians. For instance: Dogs will seek out and devour the long blades of couch-grass (*triticum repens*) when they are constipated; horses and mules will eat clay when they have "scours"; cattle with eczema have been seen to plaster hoof and joint with mud. He speaks of seeing a cow break thin ice on a pond and treat her itching joint to a mud poultice. Cats will go miles when they are "under the weather" for a dose of catnip. The saliva of animals seems to have a distinct curative action. Dogs, cats, cattle, rodents, monkeys—all lick their wounds when they can get at them, and soon effect cures. Weir also tells of a large dog-faced monkey who scratched his shoulder badly on a projecting nail in his cage. He immediately went to a corner and, seizing a handful of clean sawdust, pressed it on the bleeding scratch. In a few moments the bleeding ceased and the blood dried, leaving a coating under which the healing was prompt. Rev. Egerton R. Young,[3] a missionary in northwestern Canada, shows us that the surgical instincts of the dog may become so far developed as to produce a real surgeon-doctor. One of his dogs spontaneously took up this work, and became so expert that the Indians called him *Muskeke Atim,* the surgeon. Galls, wounds, frozen feet, etc., in the other dogs were successfully and systematically treated by Doctor "Rover." The wounds or sores that could not be reached by the dog's own tongue did not heal. The fact shows that, in a state of health and with pure food, the dog's saliva has a perfect bactericidal and healing power. Perhaps it would make an ideal antiseptic. No bacteriologist has caught the hint.

The logical or evolutional order of the subjects of my list would be to pass from the medicine of animals to that of savages, and so, finally, reach the more compact body of truth now held by the profession. I am compelled, however, to take the matter up topically, in order better to place it before you; the contributions of primitive men must, therefore, be noticed as we proceed from subject to subject.

In the history of medicine *ophthalmology* was one of the earliest subjects to command professional opinion. The eye is the most important of all the organs of sense, and blindness the greatest of afflictions. The early gatherings of medical lore, in large part, relate to the eye. The operation of *couching cataract* goes so far back in primitive times that Ælianus says that men learned it from goats, who, by pushing their heads against the thorns of a thorn-bush were accustomed to operate on their own cataractous eyes. It is noteworthy that in the operation by the Greeks a mydriatic was used and local anesthesia, as well as general narcosis, was induced.[4] The greatest discovery in this specialty is held to be the ophthalmoscope, but two others, in my estimation, far outrank it. Before Helmholtz, a non-medical man, Babbage, doubtless devised an instrument "for the purpose of looking into the interior of the eye," and even Helmholtz said of himself that it was not inclination but external circumstances that forced him to become, temporarily, a physician.

According to Dr. John Green,[5] *spectacles,* both convex and concave, were in common use by the Chinese before the opening of commerce with Europe. They were made of a transparent stone, of a color like that of a strong infusion of tea, called scha-chi (tea-stone), and were tied on the head by silken cords. The common use of some form of magnifying glass by the ancients is well proved by their perfect workmanship, as displayed in the engraving of gems; and a crystal wrought in the form of a convex lens has been actually discovered in the ruins of Nineveh by Sir Francis Layard. Pliny's description of the visual defect of the Emperor Nero strongly suggests compound astigmatism. The statement that Nero was accustomed to view the conflicts in the arena by means of a smaragdus would seem to be best explained by assuming that the emperor possessed a large, highly-polished emerald, very likely of

uneven curvature in its two principal diameters. The theory implies that the use of the gem for this purpose was the result of an observation made by Nero himself, who may, therefore, be credited with the accidental discovery of an eyeglass suited to myopia or compound myopic astigmatism; the invention apparently died with the inventor. Certain it is that spectacles were in common use for at least 150 years before the theory of their action was explained. Bifocal lenses were devised by a layman, Benjamin Franklin.

Although a physician discovered *astigmatism*, it was the mind of the natural philosopher or physicist in him that made the discovery, not that of the medical man. The discovery of the clinical significance of astigmatism was made by a physician, S. Weir Mitchell, 75 years later.

The laryngoscope is one of the best illustrations of a great medical discovery made by a non-medical man. The inventor of this instrument was a singing master of London, Señor Mañuel de Garcia, who was still living[6] in London in 1901, in his 98th year. In 1855 he presented a paper to the Royal Society of London, entitled "Physiologic Observations on the Human Voice." His investigations were carried out on himself by means of mirrors, a small one at the end of a long stem, for introducing into the pharynx, and a large one, which served both for directing the light on to the small mirror and to enable the operator to see the image formed on it. Garcia's invention was treated by the English with apathy and even incredulity. His paper, however, fell into the hands of Türck of Vienna, who failed with the device, but later, Czermak converted it from a "physiologic toy" into an instrument of scientific research and popularized its use by his demonstrations on his own throat in Vienna, London, and elsewhere.

In the seventeenth century Sir Kenelm Digby published his book on the cure of wounds by the "Powder of Sympathy." The knowledge of this wonderful powder, he says, came from a priest just returned from the Orient. By the aid of this "vitriol" he claimed to heal wounds without either touching or seeing the patient, by dissolving some of it in a vessel containing water, and putting in this water any article having on it blood from the wound to be treated. In the mean-

time the patient was advised "to cast away all plasters, only keep the wound clean and in moderate temper 'twixt heat and cold." However absurd this may seem, Draper tells us it was the beginning of the doctrine of *adhesion,* or the cure of wounds by immediate union, a practice little appreciated until the days of John Hunter; while Dr. W. A. Hammond claims that it embodied all there is of real value in our modern antiseptic treatment of wounds, and occasioned a greater revolution in the treatment of wounds than has been accomplished in later times by Lister and his followers.

I make the following excerpt from Baas[7]:

The first cesarean section on the living and parturient woman was practiced by the sow-gelder, Jacob Nufer, of Siegershausen in Thurgau, on his own wife, about the year 1500. After 13 midwives and several lithotomists had endeavored in vain to relieve her, her husband, having invoked the assistance of God and obtained the special permission of the governor of Freuenfeld, operated "just as on a sow" with such good fortune that the mother survived to the age of 77, and was able subsequently to bear several children—and even twins—in the usual way. Undoubtedly, therefore, the operation was unnecessary, and the same was true of many of the operations which soon followed; for cesarean section became the fashion for a short time. A sow-gelder is said to have removed the ovaries of his own daughter in consequence of her lasciviousness, during the 16th century (Weyer tells the story), so that such fellows and operative gynecologists are to be considered the predecessors of Hegar, and to be praised accordingly.

As a result of this enrichment of the technic of operative midwifery by a simple sow-gelder, the cesarean section seems in the course of the 16th century to have been practiced repeatedly, e. g., in Italy in 1540 by Christof. Bain; 1531, in Neusse; 1549, by Paul Dirlewang, on Marie Volcser, in Vienna, etc. Now, however, it was performed in a somewhat more becoming fashion, and chiefly by barbers, though some will admit as the first actual cesarean section only the one performed by Surgeon Trautmann in Wittenberg in 1610.

Celiotomy, according to Dr. Benjamin Howard,[8] was known by Japanese physicians of "centuries ago," one of whom wrote, "When medicines are ineffectual, as well as acupuncture, and the cautery, the abdomen and back may be opened, and the stomach and intestines washed."

According to Dr. W. J. Hoffman,[9] the Coyosteras Apaches employed a *splint in fractures* and gunshot injuries of the extremities that is well worth interest. An

illustration is shown of an appliance used by a warrior for a comminuted fracture of the middle third of the left humerus. Strips of cedar wood, ¼ inch thick, ¾ inch wide, and 8 inches long, were bound together with sinew and applied to the arm by tying the loose ends of the sinews. Through the spaces between the strips water could be applied and a free discharge likewise secured.

Dr. McClanahan[10] says of the Indian *treatment of compound fractures:*

> First, reduction by extension and counterextension. Some of the medicine men acquire considerable skill in manipulation and their results are creditable. Next all the openings are filled with bone-marrow extracts. Then over all is smeared a coating of the scrapings of rawhide boiled in water. This forms a gelatinous layer having considerable strength. Over this and around the entire limb is placed a covering of fine inner bark, when the limb is ready for the splints. These go entirely around the limb, being held in place by circular strips of cloth. If it is an arm, this is carried across the chest and retained by a circular bandage about the neck.

Franklin Staples[11] states that the Talmud describes, among other operations, one for *stone in the bladder* and others for the reduction of various fractures and dislocations.

F. Poncet[12] pictures a terra cotta image found in Phœnicia, in which there is represented a perfect hernial bandage, with two metallic plates, to be fitted over the inguinal openings. It leaves practically no doubt that the Phœnicians recognized *hernia* and knew of its *successful mechanical treatment.*

According to the Talmud, *carbuncles* were manipulated with the fingers and then cut crosswise (crucial incision of to-day). In *atresia of the anus,* splitting of the skin down to the rectum is mentioned. (Sabb. 134, 1.)

The collections of surgical instruments made from the ruins of Herculaneum and Pompeii bear witness to a high degree of specialization and art on the part of the Roman surgeons of that time.

Wunderbar enumerates from the Mishna and the Talmud no less than 56 forms of surgical instruments and appliances, exclusive of the obstetric stool referred to in Exodus, 1:16.

Surgeon-Major William Curran[13] says:

> Narrating in a kind of autobiography the adventures of Cap-

tain Creighton (who fought under Montrose or Dundee in Scotland) and describing how Creighton had sustained wounds in a fight at Airs-Moss, Swift represents Creighton as speaking of his wounds as follows:[14] "My surgeon, having unfortunately neglected to tie a string to the tent of green cloth which he used for the wound, the tent slipped into my body, where it lay under my navel seven months and five days, and pained me exceedingly. The tent lying thus in my body made it impossible that the wound could heal. Wherefore I ordered some pipes to be made in a mould through which the thin corruption continually issuing out of the wound, might be conveyed as through a faucet. These pipes I cut shorter by degrees as I imagined the wound was healing from the bottom, till at last they became too short. Wherefore I made a coarse pipe myself which was long enough. This pipe, after the wound was dressed with brandy, was removed daily; and it happened one morning when the pipe was drawn out as usual, that the tent followed. Then I knew I should soon be well."

This Captain Creighton, in 1730-1735, was, therefore, the inventor of *drainage tubes*.

According to Dr. V. Deuffe, of the University of Ghent,[15] the rectal and vaginal speculum dates at least from 1000 B. C., a Sanscrit treatise by Sussutas (translated in 1844 by Hessler), describing such an instrument. It is also mentioned by Hippocrates and by other writers of the Alexandrian school, and has been found in the ruins of Pompeii.

In casting about for some means of combating mammary cancer, Beatson became interested in the custom prevalent among Australian farmers of *spaying cows* during lactation, in order to prolong indefinitely the period of lactation. It is during this period that there is enormous reproductive cell-activity with rapid destructive cell-metamorphosis. The cells involved in this process are of the identical epithelium, which undergoes hypertrophy in cancer of the breast, the difference being that in cancer continued growth of the epithelium takes place without any breaking down of tissue. The spaying results in cows, therefore, led him to try the same operation on women with *mammary cancer* in the hope that it would set up retrograde metamorphosis of the cancer cells. In several cases of inoperable cancer of the breast, he witnessed the disappearance of the tumor after *ovariotomy*. Abbe,[16] too, reports two remarkable cases in which ovariotomy was followed by rapid disappearance of recurrent cancer of the breast.

Anders[17], writing of the Winnebago and Dakota In-

dians, says that, as regards surgery, they never amputate. In large incised wounds, the parts are carefully brought together and secured with sutures of animal sinew, which they remove in 6 or 8 days.

As to *anesthesia,* Dioscorides[13] tells of a draught that may be given to human beings, before they undergo the pain of the surgeon's knife or cautery. Later, Pliny gives the formula of this draught, which was not only reputed to annul pain but was credited with producing a death-like sleep. Dioscorides further says, "a wine is prepared from the bark of the mandragora root, and three cyathi (a little more than four ounces) of this is given to those who require to be cut or cauterized, when, being thrown into deep sleep, they do not feel any pain." Pliny[18] remarks that the juice of the leaves of the mandragora is more powerful than the root. Of such a preparation he says the dose is six drams, to be taken before cuttings and puncturings. Speaking on the same subject, Apuleius[18] says that if any one is to have a limb mutilated, burnt, or sawn, he may drink a half ounce of the preparation, with wine, and while he sleeps the member may be cut off without pain or sense.

An editorial in *American Medicine,* April 19, 1902, says:

> From the fact that ancient anatomists referred to the carotid artery as *arteria soporifera* and that the Russians still call it *sonnaia* (the artery of sleep) it appears that it has long been known that, by compression of the carotids, a state of anesthesia may be produced. It is not surprising therefore to find that among the natives of Java, Madura, and Banku, a procedure for obtaining narcosis is in extensive use under the name of *tarik urat-tidor,* or compression of the soporific vessels. The anesthetizer sits in front of the patient and grasps the patient's neck with the fingers, the thumbs placed back of and a little below the angle of the lower jaw, compresses the internal carotid artery against the spinal column. Complete loss of sensibility and of consciousness is produced. L. Steiner,[19] of Saerabaya, Java, points out the absolute harmlessness of the method, the rapidity with which sleep may be obtained, and urges that it be given a place in surgery.

Benjamin Howard[20] says that "centuries ago" the Japanese used in celiotomies a narcotic mixture which contained *Datura alba,* aconite, etc.

In *gynecology and obstetrics* hardly a ray of scientific or rational light penetrated until modern times and

civilization came to lighten the burdens borne by women of pain and superstition.[21] M. Weiss[22] says that the relation between *menstruation and ovulation* was known to the writers of the Talmud (vide Nida, 8, 1). Contrary to the Mosaic teaching, an intact or an injured hymen was not held as proof of either the chastity or the fall of a virgin; for it appears they recognized that conception was possible without the least injury to the hymen (Nida, 64, 2), while, on the other hand, mention is made of the fact that disease may give rise to destruction or atrophy of the hymen.

In *menorrhagia* astringent injections, such as the juice of strawberries and their leaves, or of plantain, was resorted to, reinforced by the use of pessaries of the leaves of plantain or knot-grass, bruised and rolled in a piece of fine linen, put "up in the womb."

Uterine prolapse was treated by reduction, followed by injections of the decoctions of galls; or, in bad cases, by the use of pessaries made of cork smeared over with wax, or sometimes made of wax alone. Fissured nipples were dressed with an ointment made of powdered elder bark, grease, and wax, i. e., an astringent.

In passing from surgery to medicine, we should note that the most ancient and persistent philosophy of disease, lasting down to our own times, was that it was due to some evil principle or spirit coming into the body from the outside, and to be fought against and driven out by any means possible and powerful. The germ theory, infection and parasitism, on which our science is now builded, shows how essentially true was the old perception.

For forty years I have been repeatedly struck by the fact that all *animals hate flies* with an intensity not entirely explained by their "suctorial," stinging, or biting powers. Our domestic animals, even our draught animals, expend as much energy in keeping off the pests as they do in our service, or in getting food. Even the most pachydermatous are not exceptions. If we observe an elephant, we are astonished at his constant watchfulness and exertions in keeping off the common flies whose suctorial powers are so feeble as to be entirely out of proportion to the energy spent by the elephant. Might not bacteriology have received a hint here of service in discovering the etiology of disease? Did not Nature long ago thus find out that flies might be the

carriers of disease germs? Science is now rapidly advancing toward the same discovery. The entomologist of the United States Agricultural Department, Dr. Howard, after long studies, believes that flies are often the active agents in spreading typhoid fever. The bacillus of Eberth has been found in flies, and if Dr. Howard is right, then the profession must educate the public and nurses, and so order hospital construction and service that flies shall have no access to food.

In the Talmud (Ketuba 77:2) is mentioned a disease, "Rotz," characterized by weeping eyes and a discharge from the nose and mouth (influenza?) said to be communicated from man to man, sometimes by flies! The malady is plainly and unmistakably ascribed to an animal parasite.

In the light of the importance now being attached to flies as the carriers of contagion, much interest attaches to the fact that precautions against breeding grounds for flies about camps are to be found in the Scriptures. That grand old sanitarian, Moses, found it necessary to be most explicit in the management of camps. In Deuteronomy, 23: 12-14, the old version reads: "Thou shalt have a place also, without the camp, whither thou shalt go forth abroad. And thou shalt have a paddle upon the weapon; and it shall be when thou wilt ease thyself abroad, thou shalt dig therewith and cover that which cometh from thee." The new version reads: "Thou shalt have a paddle among thy weapons," and, as a variant for paddle, gives "shovel" in the margin. The passage, therefore, means that a shovel for burying excreta immediately is a necessary implement for the members of every camp.

In a great empire[23] no question can be of more importance than the study of *malaria*. When we speak of one of our possessions as "unhealthy" it is in terms of "malaria" that we judge it. "Of all the diseases in our tropical possessions," says Dr. Willoughby Gardner in his interesting address to the British Medical Association, "by far the most important is malaria. It undermines the health of millions, and makes vast regions which would be otherwise our richest possessions, almost uninhabitable." In India alone, it kills every year some five million people—twice as many as cholera, smallpox, plague, and other infectious diseases put together. Indeed, one is almost tempted to agree with a writer in the Quarterly who says of the malarial germ "that it has played a greater part in human affairs

than the greatest politician or general that ever lived." The first step in dealing with it was the discovery by the Romans, in the dawn of sanitation, that marshes and deficient drainage had much to do with its origin.

Herodotus writes (chapters 95-6) that the contrivances which the Egyptians use against the *gnats* wherewith the country (Egyptian marshlands) swarmed are the following: In the parts of Egypt above the marshes the inhabitants pass the night on lofty towers, which are of great service, as the gnats are unable to fly to any great height on account of the winds. In the marsh country, where there are no towers, each man possesses a net instead. By day, it serves him to catch fish, while at night he spreads it over the bed in which he is to rest and, creeping in, goes to sleep underneath.

A correspondent of the *British Medical Journal* (Aug. 30, 1902) writes that in 1864 one of her majesty's sloops anchored off Ajiabambo, in the Gulf of California, "dollar hunting," and sent boats ashore, the crews of which were to proceed a short distance inland to obtain the dollars which, in those days, the Mexican government did not allow to be exported. The medical officer seeing that the country was sandy and covered with brushwood, feared that malarial fever might result with the men so employed, but was assured by a resident that there were no *mosquitoes* and that "where they do not exist there was no chance of malarial fever." The officer reported this to the medical department of the navy, but it attracted no attention.

In the fifth century, B. C., Empedocles of Agrigento is said to have freed Selinante from fever by drainage of the stagnant waters about the city. A number of Roman writers are quoted by Marchiafava and Bignami,[24] showing that marsh lands were injurious to the health of man, because of the miasms, invisible animal and insect life, emanating from them. It was suggested that the mosquito was the origin of malaria as early as 1618. The Abyssinians[25] knew where and in what months malarial diseases are most prevalent and, by acting on this knowledge, they generally succeed in avoiding malaria. When absolutely obliged to cross such places as the valley of the Mareb in the fever season, they continually explode blank cartridges and light damp fires to keep away "the fever." The Chillooks and Bongos of the Upper Nile make great fires

of dried cow-dung when their herds come in at night. Thus a cloud of smoke hovers over the village and protects men and beasts from the mosquitoes. The Andaman Islanders plaster their skins with a mixture of lard and clay to protect themselves from the bite of these insects. The scientific demonstrations of the relation between the mosquito and malaria is recent, but the natives of malarial districts suspected it long ago and protected themselves accordingly.

Alexander von Humboldt[26] says some of the Orinoco tribes of natives smear themselves with red paint, "to keep off the mosquitoes, probably."

A traveler through British Honduras relates[27] the following incident:

> One trifling incident will cause me to remember the negro colony at Tambol. In the Peten I saw a few cases of the disease called "pinta" which seems to be a dystrophy of the body pigment. It leaves the skin colorless or apparently white in blotches. Face, limbs, and body are liable to attack. Not only is it probably congenital, but it may be acquired by contact. On this particular evening the air was full of mosquitoes, and as we sat in the hut a man covered with the pinta blotches came to the door and would have entered, but the Carib woman drove him away, explaining her conduct by saying: "Signor, it is very bad that the mosquitoes that bite him should bite us. We catch pinta, tombière!" The mosquito is here regarded as the disseminator of all manner of diseases, especially the pernicious fever of the tropical coast. So, the science of the natives is not so very far behind the times.

Indeed, the historic foreshadowings of the theory of the microbic origin of disease are too numerous to gather here. But more than to any other we owe to Pasteur the discovery of the microbic origin of contagious diseases—and Pasteur was not a medical man, not even a physiologist; he was simply a chemist. By his researches as to the origin of silk-worm disease, of charbon, or splenic fever, of chicken cholera, etc., he laid the foundations of preventive medicine, a branch of science which is, beyond question, the greatest benefactor of civilization.[28] His work on rabies must also not be forgotten.

The *Quarterly Review* of July, 1899, says that the prohibition of pork among the Israelites and Mohammedans probably arose from the danger of *Tænia solium* and *Trichina spiralis;* and the general use of hot drinks, like tea in China, was probably based on acquaintance

with the ill effects that may result from the use of polluted water. . . .

And, as to *immunity,* natural and acquired, there have long been suggestions of the truth in the habits of animals, and in human life everywhere. Old citizens of rattlesnake countries know of dogs which are not only fearless but which find their chief pleasure in hunting these snakes. Having been bitten and escaped death after their first experience, they become thereby immune, and thereafter progressively so with each fight. It is strange no physician ever realized the significance of the fact.

S. Weir Mitchell[29] says that it was an astronomer (Galileo) who gave us the first rude *thermometer,* and it seems to have been another, Herman Kepler, who first, and certainly before 1600, *counted the human pulse,* or, at least, left a record of having done this memorable thing. Does it not, Mitchell asks, seem incredible that of the numberless physicians who sat by bedsides, thoughtful, with fingers laid on that bounding artery, none should have had the idea of counting it?

It is strange that physicians should have waited until 1858 before seeing the use of the thermometer in medicine. In that year Wunderlich first described and urged its use, although the writings of Newton and Franklin show that it had been used long before for ascertaining the temperature of the human body. It was such a curiosity that one, about a foot long, is said to have been exhibited, less than 45 years ago, at a meeting of the British Medical Association by Sir Samuel Wilks, exciting curiosity and levity.

K. N. Macdonald[30] says: *"Inoculation with smallpox virus* has been practised by the Burmese from time immemorial. Among them, smallpox was called the inevitable disease, because of their idea that it is rooted in the human body from the time of birth. The usual procedure in inoculation is to mix the virus with milk and insert it under skin of the arm."

Immerman[31] claims that accounts of the inoculation of human smallpox may be found in the records of the most ancient times. Long before the beginning of our chronology, variola was purposely inoculated as a prophylactic measure in Hindoostan and China. In the latter country, the method never progressed beyond clothing the individual to be inoculated in a shirt im-

pregnated with variolous pus or stuffing dried smallpox crusts into their noses. These measures frequently failed and they still more frequently led to violent variola. It is probably true, however, that in China the method never progressed further than this. In Hindoostan, on the other hand, the priests traversed the country in the spring of every year, and the virus was introduced by means of scarifications made on the outer surface of the arm or forearm, 15 or 16 in number, one-half inch long, and parallel. This area was then covered with a compress of cotton wool impregnated with the virus and moistened with the water of the Ganges. In addition to Hindoostan and China, with their primitive methods, it has been established that prophylactic inoculation was practiced by the inhabitants of Barbary and Senegal in Africa, and by the Circassians and Georgians in Asia before it crossed the Bosphorus.

Immerman[32] says that the fact that the so-called *vaccinia* (cowpox) was capable of transmission to the human individual has been known for an indeterminate period of time. Long before the days of Jenner it had been observed that individuals who had never had smallpox, but who had accidentally been infected with cowpox, remained immune when subsequently exposed to variola. Alexander von Humboldt, for example, says that since the earliest recollection of man, certain tribes of Indian shepherds in the Mexican Corderillas had been thoroughly convinced of the protective effect of vaccinia against variola. Brun makes a similar statement in reference to the clan of Elihats in Beluchistan. The belief in the immunizing effect of cowpox was also prevalent among the country and dairy folk of Europe and thoroughly rooted in certain parts. The tradition brought, by a dairy maid, under Jenner's notice, was widely spread in all the dairy districts of England and Ireland; it was prevalent in as many as 18 English countries.[33] Benjamin Jesty, a farmer of Dorsetshire, England, was probably the first person in Europe to *vaccinate with bovine virus for prophylactic purposes*.

The material relating to Jesty has been set forth by Crookshank in his work on the "History and Pathology of Vaccination," and it has been summarized by Dr. McCrae in the *Johns Hopkins Bulletin* for February, 1900, his article being illustrated by Say's engraving of Sharp's painting.

Benjamin Jesty[51] was born at Yetminster in Dorset, and was a farmer who moved to the farm of Downshay in the Isle of Purbeck, near Swanage, in Dorsetshire. He appears to have been an eccentric man, full of quaint actions and speech, but with good power of observation and of sensible reflection on what he had observed. In 1774 smallpox was prevalent in his locality. He was thought to be in no danger of it himself, as he had already acquired cow-pox, which he had contracted accidentally from the cows. Some of his famly were not so protected, and the fact that two of his maidservants, who had previously had the disorder from the cows, attended patients suffering from smallpox without infection, seems to have determined Jesty to inoculate the cow-pox into his own family as a preventive of smallpox. Accordingly, Jesty carried out his ideas and inoculated his wife and two sons, aged 2 and 3 years, with the cow-pox. The patients went into the fields and the virus was taken on the spot from the teats of the cows. A stocking-needle was the instrument used, Mrs. Jesty being inoculated under the elbow, the sons above. The latter had the disorder in a favorable way, but in the course of a week Mrs. Jesty's arm was much inflamed. She had fever, and was so ill that a neighboring surgeon, Mr. Trowbridge, of Cerne, was called. He said: "You have done a bold thing, but I will get you through it if I can." She soon recovered perfectly, but the boldness and novelty of the attempt produced no slight alarm in the family and no small sensation in the neighborhood. Fifteen years later, in 1789, the sons were inoculated for the smallpox by Mr. Trowbridge along with others who had not had the cow-pox. The arms of the Jestys inflamed, but the inflammation soon subsided, and no fever or other variolous symptoms were observed, while the unprotected individuals went through the usual course of inoculated smallpox. Subsequently Mrs. Jesty and her sons were often exposed to smallpox without taking it, while in 1805 one of the sons was again inoculated with a negative result. In 1805 the Jennerian Society persuaded Jesty to come to London for five days for the purpose "of taking your portrait as the earlicst inoculator for cow-pock, at the expense of the institution; you will receive fifteen guineas for your expenses." He came and his portrait was duly taken, but he conceived a very unfavorable opinion of the metropolis, though he admitted it possessed one great merit, namely, that he could be shaved every day. He died April 16, 1816, at the age of 79, and he is buried in the little village churchyard at Worth Maetravers.

I can not forbear admitting that this magnificent act of Jesty has never been rated at its true value. That Jesty was a layman does not detract from the honor that is his due, but, to my mind, adds to it. Neither Jesty nor Jenner discovered the fact of immunity from

vaccinia, and neither could explain it. That Jenner waited 25 or 30 years after the dairy folk had found the truth, and 22 years after Jesty vaccinated his family, before he vaccinated the Phipps boy, is not a reason for making Jenner the discoverer of vaccination. That honor seems to me to be due to Benjamin Jesty.

It appears[35] that the Chinese have long observed the association between the death of *rats* in the house and the appearance of a case of *plague* a few days later in the family living there. J. Campbell Gibson[36] directs attention to the fact that the disease which preyed on the Philistines, described in Samuel I, chapter v, vi, was bubonic plague, and that they recognized the dependence of the spread of this disease on rats (or mice as the text has it); the Philistines (who thought to appease Jehovah by sending back his ark) sent, at the same time, as guilt offerings, golden images of the tumors, the chief symptoms of the disease in those cases which were not fatal, along with golden images of mice. The importance they attached to this relation is plainly shown by referring to the Septuagint, wherein the tumors are spoken of as "plague boils," and it goes on to say "in the midst of the land thereof, mice were brought forth, and there was a great and deadly destruction in the city." The description of the disease is quite clearly that of bubonic plague; the recognition that mice were responsible is very interesting.

"Among the means of protection possessed by the living organism against infectious diseases and toxic agencies, laboratory investigation has placed the *bile;* but, as is true of so many other facts in medicine, empiric knowledge anticipated scientific discovery.[37]

It appears also that, from time immemorial, the peasants of central France have been in the habit of using the gall bladder as a remedy for viper bites. They seem to have anticipated the interesting and valuable experiment of Phisalix, Neufeld and Valée and others concerning the antitoxic properties of the hepatic substances. In the *Revue Scientifique* (Feb. 23, 1901) a correspondent adds this statement: "The natives of Bengal are not alone in knowing the antitoxic power of the liver and in employing it therapeutically. Although Professor Frazer of Edinburgh first showed by scientific experiment that the bile of the serpent is an antidote against the venom of that creature, the natives

of Guiana[38] have, for years and years, treated poisonous bites with a powder composed of the liver and bile of the serpent. Moreover, in California, the Indians do the same thing.[39] And at our watering places to-day[40] one may see fishermen treat stings and pricks with a plaster of fish liver. It is interesting that such practices, scattered here and there, all over the globe, among the most diverse peoples, are not at all so irrational as might at first sight be thought. They are justified by the brilliant studies of Frazer on the action of the bile against venom, by those of Frantzius on the action of bile against the virus of rabies, and by those of Vicenzi on the action of bile against the virus of tetanus.

In *materia medica and therapeutics* our modern knowledge and methods of treatment are often accretions of the ages, and sometimes precisely those of the earliest times.

R. H. True[41] says that less than two dozen of the botanic drugs now in use, have been introduced during the century just closed. He defines "materia medica as that body of substances which, in the popular belief, possess efficacy as remedies, although no confirmation has been offered by science. Indeed, science has often merely put its official stamp on folk beliefs in producing our present materia medica." "The beginnings of our present materia medica antedate the most ancient papyrus or inscription. It seems to have had its beginning in Egypt, Phoenicia or India. There is even a hint of our modern hemotherapy, as arterial blood, dried and powdered, is sometimes used as a restorative."

The Talmud "pharmacopeia"[42] shows that there were used infusions, decoctions, draughts, wines, vinegars, syrups, liniments, cataplasms, blisters, ointments, electuaries, plasters, powders; also cathartics, emetics, tonics, sudorifics, expectorants, abortives, hemostatics, astringents, poultices. The following substances also receive individual mention: Wine, vinegar, honey, whey, cotton seed, walnut and olive oil, garlic, mustard, pepper, coriander, ginger; also ox-gall, calamus, aloes, myrrh, mint, cotton-plant, hyssop, thyme, broomtop, poppy, acacia, mandragora, mandrake, mush, mercury, soda, borax, alum, iron, copper, lead and yellow arsenic.

S. S. Cohen[43] observes that the use of *Passiflora incarnata* is not original with the medical profession, and goes on to say that Benjamin Rush told his students

that they could learn many useful methods of treatment even from "quacks and old women." There is much that may be learned of drug-therapy from irregular practitioners whose crude reports of uncritical observations frequently contain accounts evidently truthful of trustworthy experience.

The use of *light as a curative agent* is said to have been discovered by accident and by laymen. In a communication to the Academie des Sciences, Dr. P. Garnault tells of his success in the use of light in the treatment of rheumatism and other diseases. His attention was first drawn to the subject by M. Trouve, who observed that a workman afflicted by rheumatism was completely cured by remaining in the vicinity of an intense arc-light used for an electric fountain, and, subsequently, that in works employing electric soldering, in which there is a great effulgence of light, workmen had ceased to be affected by such diseases as rheumatism and gout.

Another version is given by *The Practitioner* as to the light treatment of lupus:

> Four or five years ago (so runs the story) a watchmaker of Berlin was the subject of lupus of the face, for which he had been treated in the clinic of Professor von Leyden at the Charité Hospital. As the condition did not improve, the patient left the hospital and resumed work. He was in the habit of using lenses of high power. One day, whilst examining the inside of a watch, he was standing close to the window. The rays of the sun passed through the lens, the focus of which happened to be on a part of the man's face affected by the disease. He felt a sharp pain, and on looking into a glass he saw that the burnt spot had become white. He repeated the experiment on the following days, keeping the lens sometimes for hours between the sun and the ulcerated places. In six weeks cicatrization had taken place, and the patient went to show himself to Professor von Leyden, who had declared that the disease was incurable.

"It is a fact that some of the greatest advances in medical treatment have been due to outsiders. But even if it be true that the watchmaker did discover for himself that lupus could be burnt with a lens, the fact can not detract in the least from the merit of Professor Finsen's achievement in working out the rationale of the process and the details of the method. The account of his experiments, given in his little book on 'Phototherapy,' which has been translated into English by

Dr. Sequeria, of the London Hospital, is an admirable example of scientific method."

The writers of the Talmud[44] understood *massage with oil inunctions; diaphoresis* by means of warm baths; and, most noteworthy, *venesection* for plethora and quinsy! (Sec Joma, 84, 1.) The *therapy of water* was also crudely understood (Sabb. 78, 1). Even *hypnotism* was resorted to, but without any appreciation of its real nature. By laying on of hands, hysterics were cured of blindness, paralysis, hysteromania, and catalepsy (Joma 84, 1).

The routine treatment, says Anders, of *intermittent and remittent fevers* by the Winnebago and Dakota Indians is an emetic or cathartic, followed by a vapor bath in the sweat house and then a cold plunge. The after-treatment consists in a tonic made by decoction of the willow. In *rheumatism* they rely almost wholly on the vapor bath, also the black cohosh (*cimicifuga*) in decoction, treatment hard to improve on to-day.

For *mucous enteritis* and *dysentery* they rely entirely on decoction of buttonwood bark (or American sycamore), which Anders says is singularly effective in their hand. They also use *Geranium maculatum* (cranesbill) successfully in *diarrhea.*

H. M. McClanahan,[45] who lived among the Gros Ventres and Assiniboine Indians, says they have learned by observation that it is necessary that the skin, bowels and kidneys should perform their several duties. They induce perspiration most effectually by means of their sweat houses. These are about 4 feet high, 8 feet in diameter, and sunk one foot below the level of the ground. In the center of the dug-out, which is covered almost air-tight with blankets, are placed very hot stones, over which hot water is poured, and the occupants of the bath thus get a steam bath. (Observe how the Turkish bath is foreshadowed.) Then, unless it be freezing weather, the bathers go from the bath to the river and plunge in. To produce catharsis, they sometimes resort to abdominal kneading to excite peristalsis as we do to-day. In suppression of urine, small heated stones are placed under the patient's back, failing in which the steam bath is resorted to. Recognizing that an unarrested hemorrhage means death, they use compression and spider's web, the latter to favor clotting of the blood.

R. H. True[46] says that in the seventeenth century, the wife of the governor of one of the Spanish colonies (Peru), west of the Andes was attacked by malarial fever, and seemed likely to die. The natives gave to a Jesuit missionary, who worked among them, bark from a certain small tree, telling him to grind it up and give it to the countess at regular intervals. She recovered and, being of a philanthropic disposition, obtained a quantity of the powdered bark and sent it to Europe for use among the poor. In due time, the trees and plants were botanically investigated and named by Linnaeus, in honor of the house to which the countess belonged, "Cinchona."

The Aconitum[47] of the Greeks and Romans refers in all probability to the *Aconitum napellus*. The ancients were well aware of the poisonous properties of the aconites. It was used by the ancient Chinese[48] as an arrow poison, and is still in requisition among the less civilized of the hill tribes of India. Something of the kind was in vogue among the aborigines of ancient Gaul.[49] "The use of *buchu leaves*[50] was learned from the Hottentots by the colonists of the Cape of Good Hope." At a very ancient date *camphor* seems to have been a well-known medicine among the Chinese, and *menthol* among the Japanese.

Coca leaves[51] were cultivated by the Incas prior to the Spanish invasion for use on long journeys, to ward off fatigue. This fact drew the notice of Europeans and the discovery of coca and cocain resulted. W. G. Mortimer[52] states that there is a custom among the Peruvian natives of opening old graves for the purpose of recovering sacred relics. When these old graves are opened, although there is no apparent odor, those who explore them are very apt to get a sore throat from inhaling the vapors or impalpable powder into which the bodies fall as they are exposed to the air. It has long been a custom to fortify against this condition by the use of coca, thus illustrating the intuitive adaptation of a native remedy empirically which it has required long years of study to apply since in a scientific way in the treatment of throat troubles.

Zelia Nuttall[53] takes the following from an unpublished manuscript in the Royal Library at Madrid on the customs of the ancient Mexicans: "Inflammation of the gums is cured by lancing them with an obsidian

knife and rubbing in a little salt with the finger. Or heat a red pepper or capsicum and press it along with a grain of salt as tightly as possible on the painful spot. If these remedies do not suffice, draw the tooth and put a little salt into the hollow place." It is certainly interesting to find, in ancient Mexico, the employment of the modern *capsicum* toothache plaster, and to realize that centuries of experience had taught the natives the value of capsicum as a counter-irritant and of salt as an antiseptic.

There is no doubt that the use of *collodion* as a flexible antiseptic dressing is foreshadowed in the way these same Mexicans burned wounds (cauterized them) and then covered them with the melted juice of the *ulli plant*—the india rubber plant. All this was prior to the Spanish Conquest.

Curare, under the various names of curara, woorara, wourali, etc., was used by the natives of Demarara and the valley of the Amazon to poison their arrows. T. L. Brunton[54] says that an animal wounded with one of these arrows soon lags behind the rest of the herd, and quietly dies without any sign of suffering, appears, indeed, to go quietly to sleep. After the animal was apparently dead, however, it was found by Europeans whose notice was drawn to the subject that the heart could be felt beating vigorously for a considerable time, and if an artery were cut across the blood was ejected forcibly from it. It therefore occurred to Sir B. Brodie in 1812 that if he could keep up the respiration until the poison was eliminated the animal could be saved. This was done, and a most valuable agent for physiologic experiment discovered.

The forerunner of *tannic and gallic acid* as applied to hemorrhages may be found, according to Dr. D. Mitchell,[55] in the use made of the decoction of oak-tree leaves in hemoptysis.

Jaborandi leaves,[56] collected in the Amazon Valley, first attracted the attention of explorers by its use in the hands of natives as a remedy for snake bite.

The *Kola nut* is made of much use by the African natives, who attribute to it divers medical properties. For instance, the nuts are used for their stimulant sialagogue and stomachic properties. The Africans[57] chew them, much as the Brazilians do coca, and ascribe to them quite as marvelous effects. These latter are

found to be almost wholly due to the caffein which is present in the proportion of about 2 per cent.

A decoction of willow bark[58] was used by the American Apache Indians for intermittent fever. Our *salicin* is derived from this source to-day.

Strophanthus,[59] a remedy now widely used for heart troubles, was first brought to the notice of explorers of equatorial Africa as a very deadly arrow poison, so deadly as to paralyze the heart by means of the smallest wounds.

A. J. Currie says that Pliny (xxiv 9) gives numerous instances of the use of herbs by the ancient Celts,[60] e. g., hyssop for diseases of the eye. Broom-top, juniper and foxglove have long been known as remedies for dropsy, and, in suitable cases, with good results. For the cure of "white lights," an old Scottish name for pulmonary tuberculosis, nourishing food and fat substances were found to be of great vaue. *Oil from the blubber of the seal* was recommended.

About the time of Herodotus[61] the acquaintance of the lay people with simples appears to have been considerable; for example, the diuretic powers of *squill* in hydropsic complaints and the effects of the salts of *iron* on disorders arising from a want of proper tone in the system.

Dr. Justus Sinexon of Philadelphia (personal communication) in the forest of northwestern Maryland observed the guides eating *May apple* and chewing with it birch leaves to prevent griping. Dr. E. W. Kelsey of Philadelphia (personal communication) during his stay in the Klondike, found that the Alaskan natives used a decoction of *green fir boughs* as a remedy for scurvy.

In many instances the extraction of the essential principle of the plant which was first discovered by the non-medical was made by chemists who were not physicians, and who derived their zeal for research from pure science rather than from therapeutics. This is especially true of the alkaloids, among which are atropin, brucin, cathartin, cinchonin, cystisin, delphin, digitalin, emetin, gentianin, lupulin, morphin, narcotin, picrotoxin, piperin, rhubarbarin, scillitin, solanin, strychnin, veratrin.[62]

E. T. Williams[63] states that, so far as we know, Moses was the creator of preventive medicine, an idea thought to be peculiarly modern. From whatever source the fragments of his system may have been derived the system was his own and that of the Powers which guided him.

The notion of promoting health by preventing sickness was the foundation stone of the Jewish sanitary legislation. The prohibition against pork, considering the heat of the climate and its liability to be diseased, must be considered as a safe provision, especially in the light of present-day histology and trichinosis. The laws concerning "issues" or discharges from the genital organs, both of men and women, display similar wisdom. The laws concerning leprosy were strict. Every suspect had to present himself to the priest. If the diagnosis was doubtful, he was shut up for a week or two and then re-examined. Articles of clothing worn by lepers had also to be submitted. If found diseased they were burned. If doubtful they were washed and re-examined at the end of a week, when they were either burned or pronounced clean. When the walls of a house were attacked the affected parts had to be torn down and carried to a refuse heap outside the city. The remainder of the wall was thoroughly scraped, the scrapings themselves being carried out of the city and the broken places rebuilt with fresh materials. If these means proved insufficient the whole house was demolished and the debris removed from the town. Modern science may have discovered simpler methods of disinfection, but certainly nothing more thorough or effective. The object of circumcision is nowhere stated in the Bible. It probably does good by (1) reducing liability to venereal diseases; (2) as a preventive of masturbation; (3) by preventing phimosis and paraphimosis, and (4) it probably promotes continence by diminishing the pruriency of the sexual appetite.

Medicine, W. C. Bitting[64] says, never was a science among the Hebrews. Before the Exodus the hints of medicine are very scarce. For 430 years, however, the Hebrews were in bondage to the most enlightened people of the world. Herodotus (ii, 84) says of the Egyptian physician: "The medical practice was divided among them as follows: each physician was for one kind of sickness and no more; and all places are crowded with physicians, for there are physicians for the eyes, physicians for the head, physicians for the teeth, physicians for the stomach, physicians for internal diseases." Obstetrics among the early Hebrews was left entirely to the midwives (Genesis xxxv, 17). Ophthalmia with resulting blindness was not uncommon (Lev. xix, 4—Deut.

xxvii, 18) ; leprosy was known in all its forms (Lev. xiv, 3—xxvii, 4—Numb. xii, 10, etc.) ; apoplexy cut down its victims (I Saml. xxv, 37) ; consumption thrust its ghastly symptoms into family life (Lev. xxvi, 16—Deut. xxviii, 22—Is. x, 16) ; rheumatism and gout twisted the joints of high livers and perplexed men as much then as to-day (II Chron. xvi, 12—Jno. v, 2, 3) ; epilepsy threw men into foaming fits (M. R. xix, 17—Luke ix, 38) ; atrophy of limb produced deformity (I Kings xiii, 4-6—Matthew xii, 10-13). In the matter of treatment, the materia medica was scanty. Balsam (Jer. viii, 22—xlvi, 11) was a favorite drug for external application, probably effective because it was a terebinthinate and therefore antiseptic. Wine because of its alcohol was also an antiseptic.

Purging was in vogue (Prov. xx, 30). Music was used to quiet Saul in his spells of acute mania (Sam. xvi, 16), which is quite in advance of many of our methods of to-day.

Moses[65] seems to have had great knowledge of medicine. In the book of Leviticus (xiii, 3-20) we find his three cardinal principles which to-day are utilized in the management of contagious diseases, namely, differentiation, isolation and disinfection. In Leviticus iv to xxvi one can not but be struck with the directions for preserving individual and public health; the selection of portions of creatures for sacrifice and rejection of those parts of the economy whose functions are the removal of impurities or excretions; the disposal of filth in such manner that it might contaminate neither air nor water; the disposal of the dead; disinfection and purification of clothing and dwellings, and the laws of quarantine.

In hygiene, says Bitting,[66] the Mosaic medicine is supreme. The priests were skilled in preventive medicine. It was their duty to inspect and enforce sanitary arrangements. The history of the Hebrew race is singularly free from epidemics. Diet was carefully regulated. Pork was forbidden. To eat blood was a crime. Everything had to be washed before being cooked (Mark vii, 4—Lev. i, 9). Bathing was compulsory on those who had touched a leper, or those with any issue or flux (gonorrhea) or who touched anything that the diseased had touched (Lev. xv, 1-13), all men and women after copulation, women after menstruation—indeed, they ought to have been the cleanest people on earth. No doubt their

freedom from venereal disease was due to these precautions added to the cardinal one of circumcision.

The sick were isolated as far as possible (Lev. xiv, 33-45). The lepers were kept outside camps and cities and away from the highways (Lev. xiii, 45, 46); the house in which leprosy originated was entirely demolished (Lev. xiv, 33-45); a little loss of real estate was cheerfully suffered rather than endanger the public health.

The camp sanitary regulations were the very best. Every man was his own scavenger. All refuse from the slaughter of animals was burned outside the camp (Ex. xxix, 14—Lev. iv, 11—viii, 17). Even the very spoils of war as well as the soldiers were to be disinfected before entering the camp after battle (Numbers xxxi, 21-24). What was not inflammable must be bathed in fire to cleanse it and everything else had to be washed in water.

From the Mishna (or Jewish traditions)[67] we learn how carefully all unclean things were removed from the vicinity of Jerusalem and the temple; and the investigations of Signor Perotti in that ancient city have revealed how complete were the systems of sewers and the means of sewage precipitation and disposal.

The Egyptians, says Herodotus (Vol. ii, Chap. 42), were particular in preventing anything remaining above ground which by putrefaction could taint the air; and this was the reason of their obliging every town to embalm whatever died there. . . . . To pollute the Nile with dead carcasses would have been in the highest degree inconsistent in a people so particular on this point. The Persians, Herodotus tells us (Vol. i, Chapter 139), never defile a river with the excretions of their bodies, nor even wash their hands in one; nor will they allow others to do so, as they have great reverence for rivers.

Herodotus tells us (Chapter 188, Vol. 1):

> The great king, Cyrus, when he goes to the wars is always supplied with provisions carefully prepared at home; and with cattle of his own. Water, too, from the river Choaspes (the modern River Kerkhah) is taken with him for drink. Wherever he travels he is attended by a large number of 4-wheeled cars, drawn by mules, in which the Choaspes water, *ready boiled for use and stored in flagons of silver* is moved with him from place to place.

The Greeks were evidently familiar with the purifying nature of *sulphur,* for Homer makes Ulysses say:[68] "Bring me, old woman, sulfur—the remedy for impurities—and bring me fire that I may fumigate the palace."

From all of these instances, and more that might easily be added, it would at first seem as if the discovery of new medical truth were almost hopeless. So much of our new knowledge is old, so much not true, that the common practitioner feels discouraged in any attempt to make additions to the existing body of truth. But to me, the lessons of these things cited are most encouraging, and should inspire the simplest mind with hope.

1. The plainest moral to be deduced is that a large deal of the ancient wisdom is really wisdom. It has been an egotistic habit to republish the nonsense and quackeries and superstitions of medical history as conceited proofs of how superior we are to our forbears. This was as foolish as it was untrue. We are not so mightily superior as we think. When we are really so we shall not boast nearly so much. Neither have we by any means learned all that the ancients and barbarians have to teach us. Modern armies and cities could still learn a great deal from Moses, one of the greatest men, and certainly the very greatest sanitarian of all history. And just at the present time one can not help feeling that the old, unused truth is often of more importance than the new one. The death rate is twice as high as it would be if we should give society the benefit of the medical truths discovered long ago, but which in our rage and race for new discoveries we have disregarded. We most urgently need the rediscovery and the practical use of the old truths. My own specialty, ophthalmology, has literally gone to seed, especially in the old countries; and there is no new discovery in any department of medicine of late years that will to a small degree lessen human suffering as would a rediscovery of astigmatism and a practical utilization of its relief.

2. It is remarkable that savages and barbarians have learned so many great medical truths and are so successful in the treatment of their diseases. With all their neglect, superstition, ignorance and crudity they have managed to get hold of many important verities, especially in things that do not appear on the surface of their lives, and are not observed by the superficial traveler.

If our explorers were only medical men, or even if they were alive to the great need of accuracy and thoroughness in reporting facts of medical and hygienic value, we would learn much more than we have from them.

3. We are also incited by our illustrations to a more keen observation of the common people about us, even of old women and quacks. Even these have their uses, and are not altogether without perception of medical facts. No less a person than Professor James of Harvard College (and he was educated as a physician) opposed the passage of a medical practice act in Massachusetts, because he thought it might prevent the discovery of new medical truths by the people. I think he was ludicrously stupid, but he does not think so. There is nowadays little danger of the loss of new truth by the elevation of the educational standards of the medical profession. Genuine education teaches us that undiscovered truth lies all about us, and that the lowliest may not be scorned. Every eager and genuine student must necessarily be a discoverer. No disease has been exhausted. It still has secrets, and we should not fear the silly sneers of the over-self-satisfied, who rail at empiricism, for empiricism has given us our most valuable discoveries in medicine.

4. And the method by which we are able to make these discoveries is by careful and accurate observation. We must, in a way, exemplify in medicine the method of Sherlock Holmes, or better, of Zadig, as deduced from Voltaire's story by Huxley. We are prone to leave this method to the professional scientists and discoverers—and even, alas, to the quacks and scamps.

The striking lesson also appears that only by the unifying and systematizing power of modern science do the single and scattered discoveries of the world become of use to all. In all the instances cited it will be noted that prior to the rise of modern science no one people had the benefits of the discoveries made by others. Each was held in the bondage of medical barbarism, because whatever single or discrete truths were known the great mass of truths were not known, and so there was no grand or general progress. By taking all that was good in all parts of the world and systematizing them to a common beneficence our science has at a stroke already largely lifted the world out of its course of disease and is every day lowering the death rate, which is, as it were,

the thermometer of social welfare, more and more rapidly.

"One of the greatest losses in medicine," says T. Lauder Brunton,[69] "is the loss of individual experience. Men, most able and successful in the practice of their profession, die and carry their knowledge away with them. Some men record the cases they have seen, but comparatively few are able to record their experience in such a way as to make it thoroughly available for others. Science takes each contribution and gives it to all." An admirable example, further continues Brunton, of the application to medicine of the method of "tracking" (method of Zadig) used to be told by Dr. Milner Fothergill:

A surgeon, Mr. X., wishing to see the working methods of a celebrated quack, desired of the latter to be present some day at his office. The quack, much flattered that so great a man should patronize him, readily acceded to his request. Shortly after Mr. X. had taken his seat, a woman came in with a bottle of urine which she handed the quack. He looked at her, then at the bottle, held it up between him and the light, shook it and said: "Your husband's?" "Yes, sir." "He is a good deal older than you." "Yes, sir." "He is a tailor." "Yes, sir." "He lives at Scarcroft." "Yes, sir." "His bowels are obstinate." "Yes, sir." "Here," handing her a box of pills, "tell him to take one of these every night for a week, and a big drink of cold water every morning, and he will soon be all right."

No sooner had the woman gone out, than Mr. X. turned to the quack, curious to know how he had made out all this. "Well, you see, she was a *young* woman, and looked well and strong; so I guessed the water was not hers. As I saw she had a wedding ring on her finger, I knew she was married, and I thought the chances were it was her husband's water. If he had been the same age as she was, it was hardly likely he would have any illness, so I guessed he was older. I knew he was a tailor because the bottle was not stopped with a cork but with a bit of paper rolled up and tied around with thread in a way no one but a tailor could have done it. Tailors get no exercise, and are therefore apt to be constipated. I was quite sure he would be no exception to the rule, so I gave him 'opening pills.'" "But how did you know she came from Scarcroft?" "Oh, Mr. X., have you lived so long in Leeds, and don't know the color of Scarcroft clay? It was the first thing I saw on her boots when she came in!"

5. And it is not only the intellectual, the learned, the laboratory worker who can discover the new or redis-

cover the old. There is even more chance for the busy daily practitioner if he will only keep his eyes wide open and not be swayed by custom and fashion from seeing the hitherto neglected, and from ferreting out its ignored or unsuspected significance. The method of Zadig is at the disposal of the plainest country physician. He sees or may see the facts at first hand which the laboratory physician too often is prevented from actually seeing at all. And there is a perfect reason why to the end of time the individual discoverer can never have his opportunity taken from him. It is because every organism, every patient, differs from every other in the world. The protoplasm of everyone's body differs in chemical construction from that of every other. Each master's footstep is known by his dog, its scent being different from that of every other footstep in the world. Albumin has never been correctly analyzed, never analyzed twice alike. Each patient's disease is therefore peculiar and individual. Our large classes of disease are only rough generalizations, as each nation and race will have its typical protoplasm; thus all true discoveries and treatments must be individual, and the *science* of medicine can never conquer or render negligible the *art* of medicine. When our therapeutics becomes absolute and certain each patient must be treated differently. All the general truths and theory can never discover all the truth of the individual case.

6. And not only may we in our pride unsafely ignore the lay-world, far removed in time, space or culture; we are just as wrong-headed if we think there is not a subtle and even splendid medical wisdom in physiology and pathology, in the mechanism's adaptations, the healing powers and the teleologies of the tissues and organs of all living bodies. The number of articles of our materia medica derived from the animal body is so great that I can not even enumerate them here. Much of modern medical laboratory science is an attempt to rediscover the methods Nature has taken to prevent or cure disease by secretions and devices whose intricacy and ingenuity astonish us. The advance of serum therapeutics and the use of the extracts of the ductless glands are instances.

Immunity, as we have seen, is a device of Nature. We are really only now relearning its laws and taking advantage of them. Disease in the making is often discoverable in the study of habits, for we know, although we

are too prone to forget it, that function always precedes structure, and that therefore malfunction always precedes organic disease. It is a truism that every device of civilization has been previously invented and used by what in our materialistic day we are foolishly likely to call "unconscious" nature.

Viewed simply as a machine for the utilization of force, every animal body is vastly superior to man's most perfect engine. In the steam boiler and engine from one-quarter to three-quarters of the heat is wasted, and in our fireplaces and stoves about 90 per cent. In our lamps but a small fraction of the energy goes to the making of light. If we could make light as inexpensively as the glow-worm and fire-fly! If our electric machines were one-tenth as perfect as that of the electric eel!

And if this is true to the physicist, how much truer is it to the physiologist, the physician and the pathologist! The Deity of biology and of therapeutics long ago discovered the methods of cure and of the prevention of disease which we are slow in working out with our most advanced science. He calls each of us to be His co-worker!

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"Brethren and Students—I am going to open to you some notable discoveries I have made respecting the source or primary cause of all distempers incidental to the human machine; and these, brethren, I attribute to certain animalcule, or piscatory entities, that insinuate themselves through the pores into the blood, and in that fluid sport, toss, and tumble about like mackerel or codfish in the great deep; and to convince you that this is not a mere *gratis dictum,* an hypothesis only, I will give you demonstrative proof. Bring hither the microscope! . . . Take a peep. . . . Those two yellow drops were drawn from a subject afflicted with the jaundice— What d'ye see?

Last.—Some little creatures like yellow flies that are hopping and skipping about.

Hcl.—Right. Those yellow flies give the tinge to the skin, and undoubtedly cause the disease; and now for the cure! I administer to every patient the two-and-fiftieth part of a scruple of the ovaria or eggs of the spider; these are thrown by the digestive powers into the secretory, there separated from the alimentary, and then precipitated into the circulatory, where finding a proper nidus or nest, they quit their torpid state and vivify, and upon vivification, discerning the flies, their natural food, they immediately fall foul of them, extirpate the race out of the blood, and restore the patient to health.

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The case I witnessed happened in March. It is now the 3rd day of July. The wounds have healed and the men continue in good health. The natives even go so far as to maintain that if this remedy be given to a man already stricken with hydrophobia, it will infallibly cure!

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